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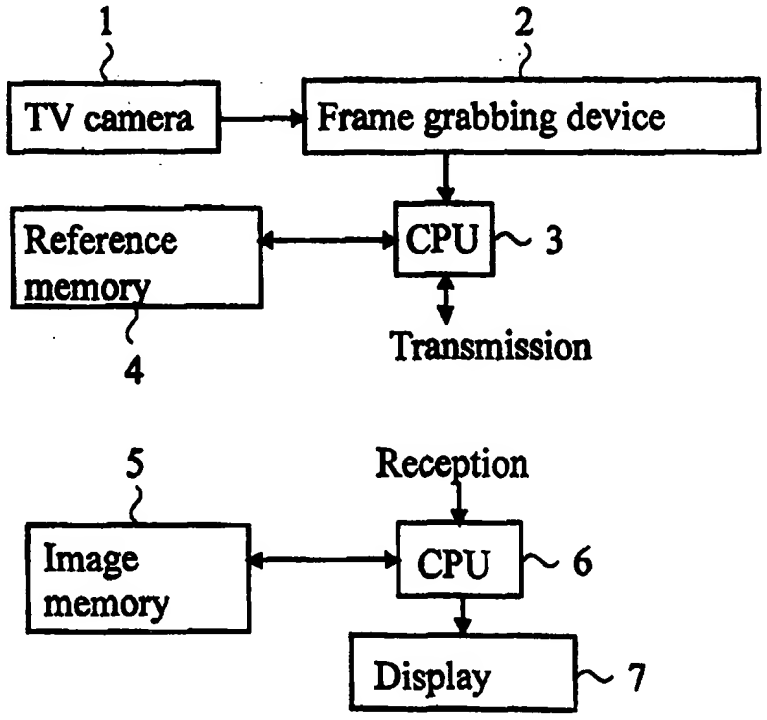
(54) Title: METHOD FOR THE TRANSMISSION OF VIDEO IMAGES

(57) Abstract

The present invention relates to a method for transmitting video images over a data communication network, in which method the video image is encoded at the sending end, transmitted, and decoded at the receiving end. For each block, the difference between successive blocks is transmitted if the block difference exceeds a predetermined threshold.



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METHOD FOR THE TRANSMISSION OF VIDEO IMAGES

The present invention relates to a method as defined in the preamble of claim 1 for transmitting video images in a data communication network, preferably a narrow-band data communication network, such as a GSM network.

In prior art, several methods for the transmission of video images in a data communication network are known. A feature typical of these methods is that the image is compressed in some way before transmission to allow faster transmission. Among the prior-art compression methods are e.g. MPEG (Moving Pictures Experts Group), and H.261 and H.263 standardized by ITU (International Telecommunication Union, ITU). The prior-art compression methods are characterized in that, instead of transmitting complete frames, only the differences between successive frames are transmitted. Moreover, predictive coding is used to reduce temporal redundancy, and modification coding to reduce spatial redundancy.

A problem with the prior-art methods is that they apply compression to entire frames and transmit all differences between successive frames. Consequently, the amount of data to be transmitted remains too high for the needs of narrow-band data communication networks. For example, if an MPEG-compressed video image with a resolution of 388*288 is transmitted over a GSM network, the transmission of a single frame may take as long as 15 seconds.

The object of the present invention is to present a new method that eliminates the above-mentioned drawbacks.

A specific object of the invention is to produce a method for processing a video image so that the image can be readily transmitted even in a narrow-band data communication network, such as a GSM network.

As for the features characteristic of the

present invention, reference is made to the claims.

In the method of the present invention for the transmission of video images over a data communication network, the video image is encoded at the sending end, transmitted, and decoded at the receiving end. The equipment at the sending end comprises a reference memory, in which the first frame of the video image is stored. Next, the first frame is compressed and transmitted. At the receiving end, the frame is stored in an image memory. The first frame stored in the reference memory and the next frame in sequence are divided into blocks. Mutually corresponding blocks of the frames are compared with each other to determine a block difference. If the block difference exceeds a specified threshold, then the difference between the blocks is compressed and transmitted. In addition, the block is stored in the reference memory. At the receiving end, the difference is integrated into the image to be presented.

In an embodiment of the method, the frame is divided into blocks having the size of 8*8 pixels.

In an embodiment of the method, the block difference is determined by comparing some of the mutually corresponding pixels contained in blocks corresponding to each other and calculating the number of pixels differing from each other.

In an embodiment of the method, the comparison of pixels is performed using some of the bits indicating pixel value.

In an embodiment of the method, the comparison of pixels is performed based on the luminance component of the pixels.

In an embodiment of the method, a predetermined part of each frame is transmitted and integrated into the image to be presented.

In an embodiment of the method, the compression method used is the JPEG (Joint Photographic Ex-

perts Group, JPEG) method.

As compared with prior art, the present invention has the advantage that it allows a considerable reduction in the amount of data to be transmitted, as the frames are divided into blocks and the difference between blocks corresponding to each other is only transmitted if the block difference is sufficiently large. This makes it possible to transmit video images in a narrow-band network as well. The method is particularly well suited for the transmission of video images obtained from a mainly stationary camera, such as a monitoring camera.

In the following, the invention will be described in detail by the aid of an application example by referring to the attached drawing, in which

Fig. 1 presents a block diagram of the method of the invention;

Fig. 2 presents a hardware assembly implementing the method of the invention; and

Fig. 3 presents an example of data flow transmitted by the method of the invention.

Fig. 1 is a block diagram presenting an example of the method of the invention. The parameter Y_p, which indicates the value of the Y co-ordinate, is set to zero. The first frame of the video image is grabbed and stored in the reference memory. The frame is compressed by the JPEG method and transmitted. At the receiving end, the frame is decompressed, stored in the image memory and presented. The next frame is then grabbed and compared block by block with the first frame. The frames are divided into blocks of 8*8 pixels. In blocks corresponding to each other, the luminance component of every second pixel is compared using five most significant bits. If the absolute difference is larger than two, then the block difference value is increased by one. If a block difference value exceeding 14 is obtained, then the difference between

the blocks being compared is large enough to be transmitted. In this case, the difference between the blocks is calculated, compressed by the JPEG method and transmitted together with position data. In addition, the block under processing is stored in the reference memory. Further, a predetermined part of each frame is transmitted. The size of this part is x-resolution * 8 pixels. The position of the predetermined part is shifted by eight pixels downwards between successive frames, in other words the value of the parameter Y_p is increased by eight for each frame until it reaches the y-resolution value, whereupon the parameter Y_p is reset to zero.

Fig. 2 presents an example of a hardware assembly implementing the method of the invention. Connected to a television camera, such as a monitoring camera 1, is a device 2 that grabs the frames for processing. The device 2 is further connected to a central processing unit 3, which takes care of image processing at the sending end. The central processing unit 3 communicates with a reference memory 4, which is used for the determination of block difference. The central processing unit 6 at the receiving end decodes the received data. Connected to the central processing unit 6 is an image memory 5, which is used to store the image to be presented. Moreover, the central processing unit 6 is connected to a display unit 7 used to present the image.

Fig. 3 presents an example of the data flow to be transmitted. The frame in the example comprises three blocks whose block differences have been found to be large enough to make it necessary to transmit the difference between successive blocks. These differences make up 192 bytes of data, which is compressed by the JPEG method to 5 bytes. In addition to the data contained in each block, the data transmitted comprises a step number *delta*, which indicates the position

of each block relative to the beginning of the frame and whose value is determined as follows: 0 -> beginning of frame, 1 -> removed by 8 pixels, 255 -> removed by 8*255 pixels from the beginning.

The invention is not limited to the examples of its embodiments described above, but instead many variations are possible within the framework of the inventive idea defined by the claims.

CLAIMS

1. Method for transmitting video images in a data communication network, in which method the video image is encoded at the sending end, transmitted, and decoded at the receiving end, characterized in that

- the first frame is stored in a reference memory provided at the sending end;

- the first frame is compressed and transmitted, whereupon it is stored in an image memory at the receiving end;

- the first frame stored in the reference memory is divided into blocks;

- the next block in sequence is divided into blocks;

- frame blocks corresponding to each other are compared to determine a block difference;

- if the block difference exceeds a predetermined threshold, then the difference between the blocks is compressed and transmitted and the block is stored in the reference memory; and

- the difference is integrated into the image to be presented at the receiving end.

2. Method as defined in claim 1, characterized in that the frame is divided into blocks of 8*8 pixels.

3. Method as defined in claim 1 or 2, characterized in that the block difference is determined by comparing some of the mutually corresponding pixels contained in blocks corresponding to each other and calculating the number of pixels differing from each other.

4. Method as defined in any one of the preceding claims 1 - 3, characterized in that the comparison of pixels is performed using some of the bits indicating pixel value.

5. Method as defined in any one of the preceding claims 1 - 4, characterized in that the comparison of pixels is performed based on the luminance component.

6. Method as defined in any one of the preceding claims 1 - 5, characterized in that a predetermined part of each frame is transmitted and integrated into the image to be presented.

7. Method as defined in any one of the preceding claims 1 - 6, characterized in that the compression method used is the JPEG method.

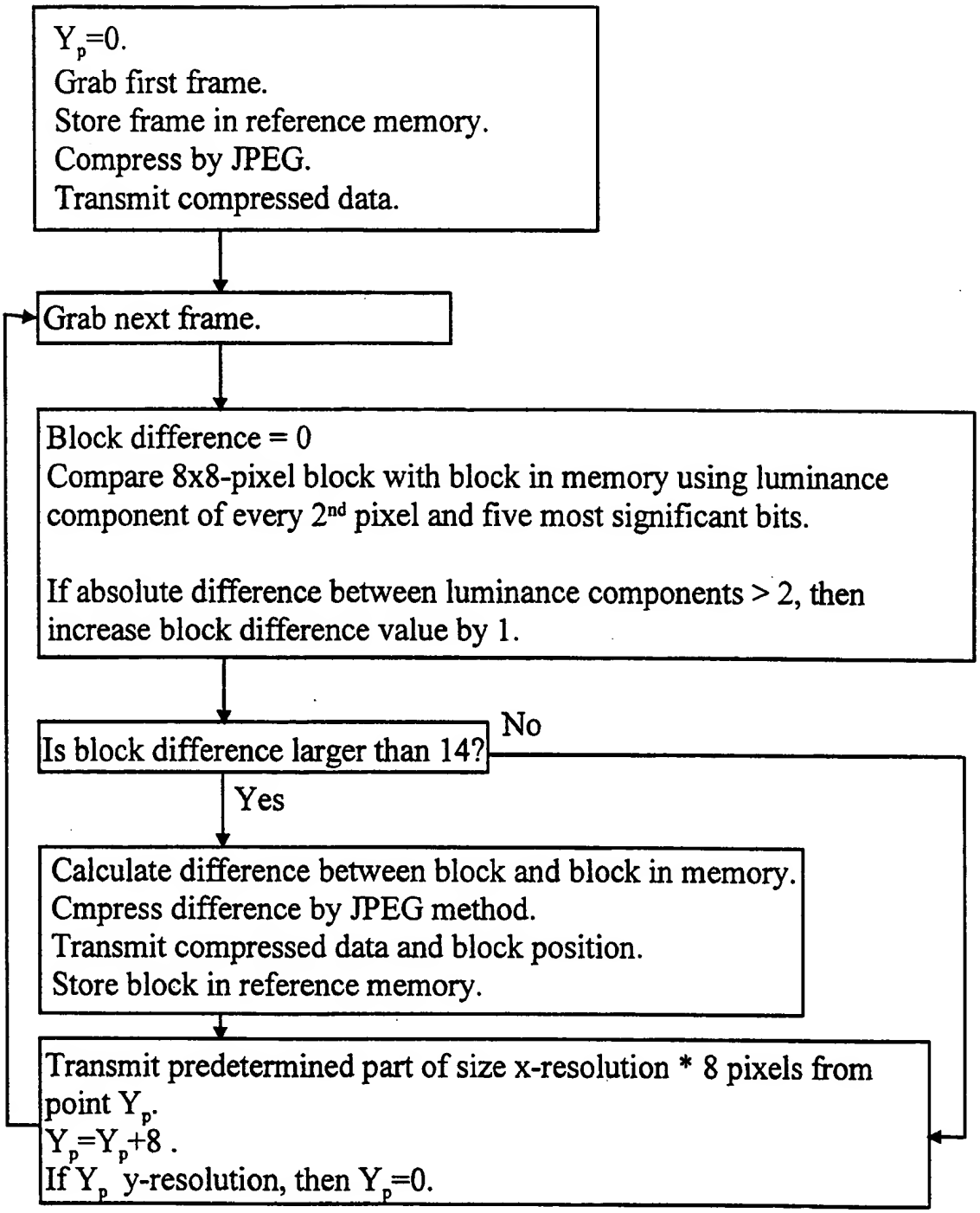

Y_p=0.
Grab first frame.
Store frame in reference memory.
Compress by JPEG.
Transmit compressed data.
Grab next frame.
Block difference = 0
Compare 8x8-pixel block with block in memory using luminance component of every 2nd pixel and five most significant bits.
If absolute difference between luminance components > 2, then increase block difference value by 1.
Is block difference larger than 14?
No
Yes
Calculate difference between block and block in memory.
Cmpress difference by JPEG method.
Transmit compressed data and block position.
Store block in reference memory.
Transmit predetermined part of size x-resolution * 8 pixels from point Y_p.
Y_p=Y_p+8 .
If Y_p y-resolution, then Y_p=0.

Fig. 1

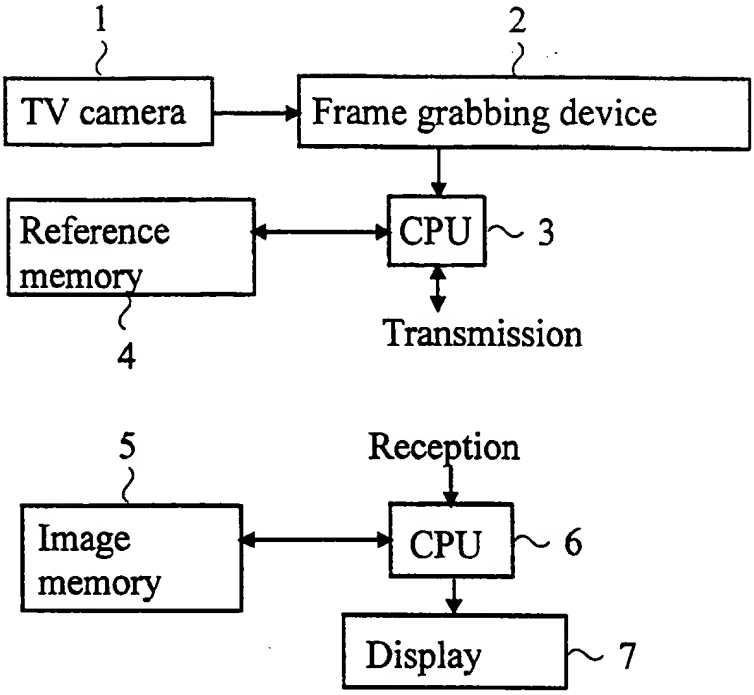
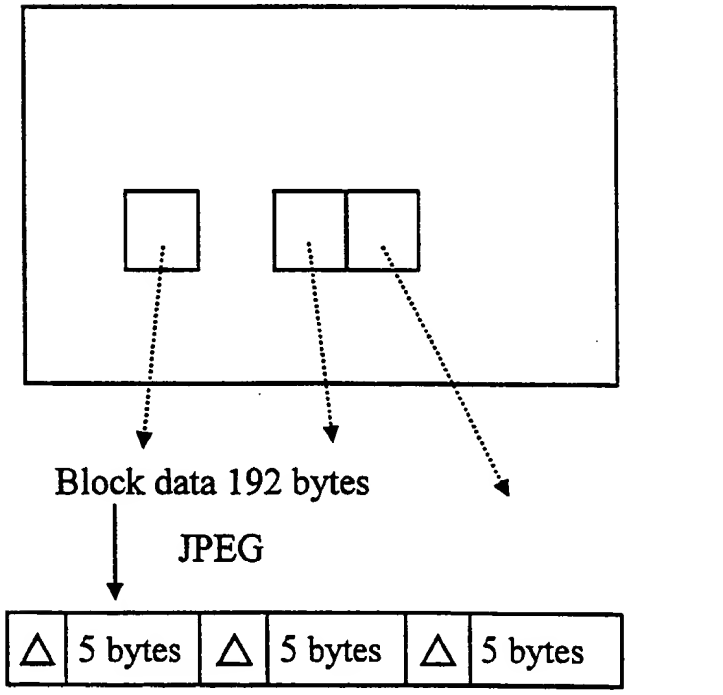


Fig. 2



△ is a step number indicating block position

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00763

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04N 7/50
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 7067105 A (SONY CORP.), 10 March 1995 (10.03.95), abstract, see the figures	1-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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